

1. Description

This power supply is completely transistorized and operates from a 115 VAC, 60 Hz external power source. The output voltage is variable and ranges from 1.2-12VDC, the maximum current under a heavy load is 275mA.

2. Functional Check

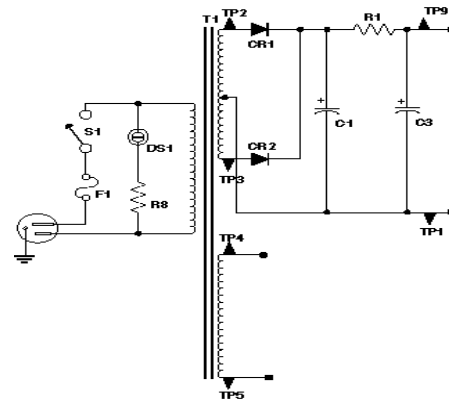
There are three loads located inside the chassis of the power supply. The values of the loads are in the following chart.

Load Type	Resistance	Jack Color
Light	600 Ω	Green jack
Normal	60 Ω	Yellow jack
Overload	32 Ω	Red jack

A functional check of this power supply consists of:

- Constant output voltage under various load conditions.
- Output voltage must vary with voltage control.

3. Unregulated Section Theory of Operation



a. Input Circuit

When S1 is closed voltage is applied from the source through F1, then S1. DS1 lights and R8 limits the current.

The 115VAC source voltage is then applied to T1's primary. This voltage is stepped down to 42VAC on the first secondary (TP2-TP3) and 33VAC on the second secondary (TP4-TP5).

b. Rectifier Circuit

This type of rectifier circuit is a fullwave rectifier. It is connected to the first secondary of T1 and consists of CR1 and CR2.

The 42VAC applied to this circuit is converted to 29V pulsating DC.

c. Filter Circuit

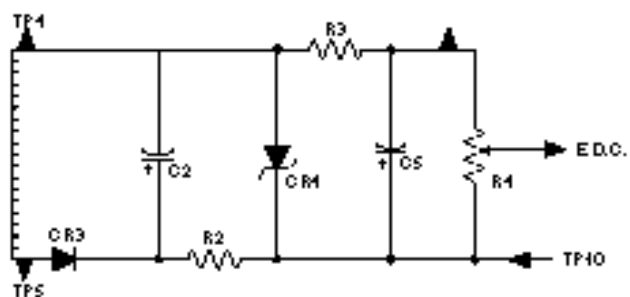
The designation of this filter circuit is a PI Filter. It is connected to the cathodes of CR1 and CR2. It consists of C1, R1, and C3.

Voltage is applied to C1 and it charges to 29VDC. C3 charges to 25VDC, R1 is in series and drops the remaining 4VDC.

The output of this filter circuit is smooth DC and is nominally 25VDC, under normal load conditions.

4. Regulator Section Theory of Operation

a. Reference Voltage Circuit



This circuit provides a reference output which is in series with the output. The output of the RVC is negative in reference to the output of the power supply. This creates a series opposing circuit. The difference provides a base bias reference voltage for the Error Detector circuit. The output of this circuit controls the output of the power supply.

The input to this circuit is 33VAC from the second secondary of T1. This voltage is applied to the half-wave rectifier circuit consisting of CR3 and is converted to pulsating DC.

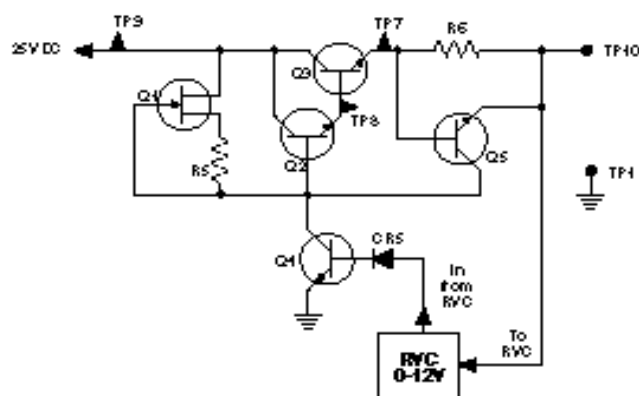
Pulsating DC is applied to a Capacitive filter (C2). C2 charges to 42VDC when the input is large enough to forward bias CR3. C2 discharges through R2 when the input falls to a level below where CR3 is reversed biased giving a smoothed DC output.

42VDC is applied to CR4 which goes into avalanche breakdown at 20VDC. This allows a constant 20VDC as the output of CR4. The remaining 22VDC is dropped at R2.

C5 is in parallel with R4 and acts as a filter to maintain a steady output across R4.

R3 and R4 are in series. R3 drops 8VDC which leaves 12VDC to be dropped through R4. R4 is a potentiometer used to vary the power supply's output voltage. When it is fully CCW it drops 12VDC between TP10 and the wiper arm. This gives an output of the Reference Voltage Circuit (RVC) of 12VDC. When R4 is fully CW it drops 0VDC between TP10 and its wiper arm, giving an output of the RVC of 0VDC.

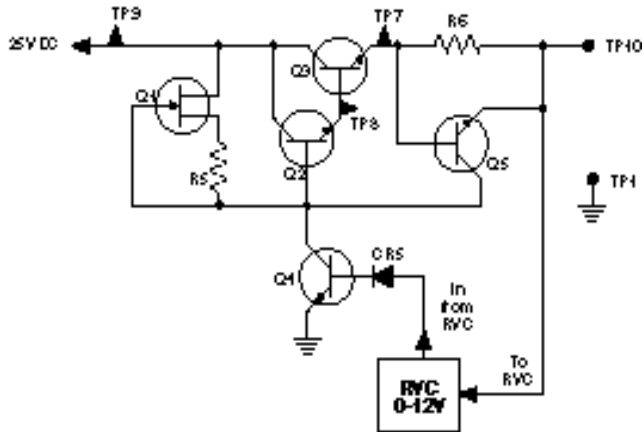
b. Error Detector Circuit



This circuit is used in conjunction with the constant current circuit to control the output of the power supply by controlling the output of the Darlington Pair.

When R4 is at its fully counter clockwise position it is dropping approximately 12VDC. The difference between this voltage and the output voltage (TP1-TP10) is enough to forward bias CR5 and enable Q4 to conduct at a nominal rate.

When R4 is at its fully clockwise position it is dropping approximately 0VDC. The algebraic sum of the voltage drops between TP 10, the emitter-base of Q4, and CR5 which cause Q4 to conduct more.



c. Constant Current Circuit

This circuit is combined with the Error Detect Circuit to create a voltage divider for the base of Q2. This voltage develops the output for the power supply.

When Q4 conducts more the increase of current through R5 increases R5's voltage drop (V_{gs}). This causes Q1 to pinch off the channel more, which will increase the voltage drop across the channel of Q1. This causes less voltage to be present at the base of Q2.

When the bias on Q4 decreases the V_{gs} decreases thus causing Q1 to reduce the voltage drop. This increases the voltage the base of Q2.

d. Darlington Pair Circuit

This circuit can also be called an emitter-follower regulator. It is used as a voltage regulator. In this power supply it is in series with the output. The purpose of this circuit is to provide the current needed by the load to maintain a proper output voltage.

The base bias voltage provided by the voltage divider (Q4, Q1, R5) is approximately 1.5VDC higher than the desired output voltage. This drives the Darlington Pair into conduction. When it conducts it provides a path for current to flow from the TP1 through the load, R6, and emitter to collector, to the positive 25VDC potential on the output of the Filter circuit.

e. Current Limiter Circuit

The Current Limiter circuit is composed of Q5 and R6. This circuit is used to ensure that the maximum current on the output is 275mA. The Current Limiter Circuit is normally not conducting.

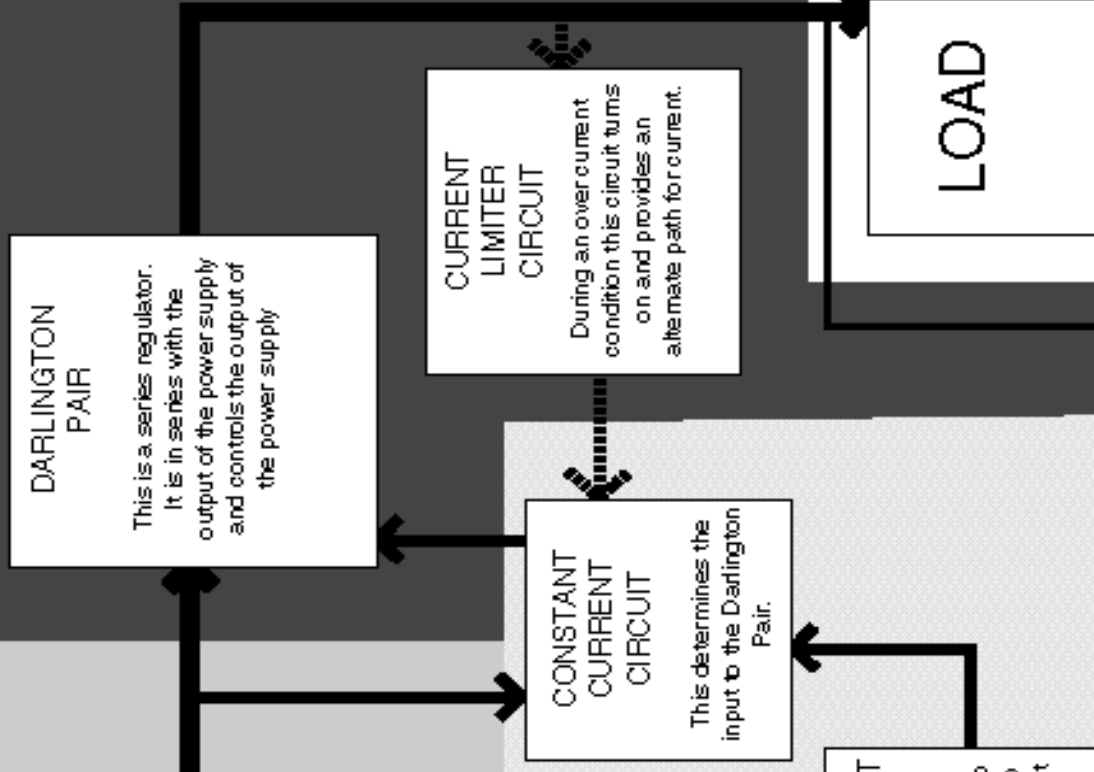
When current exceeds 275mA through R6 there will be voltage increases above the .6V E-B threshold of Q5. This will turn on Q5. Q5 now provides another path for current and the majority of current flows through Q5 to the +25VDC potential via R5 and Q1.

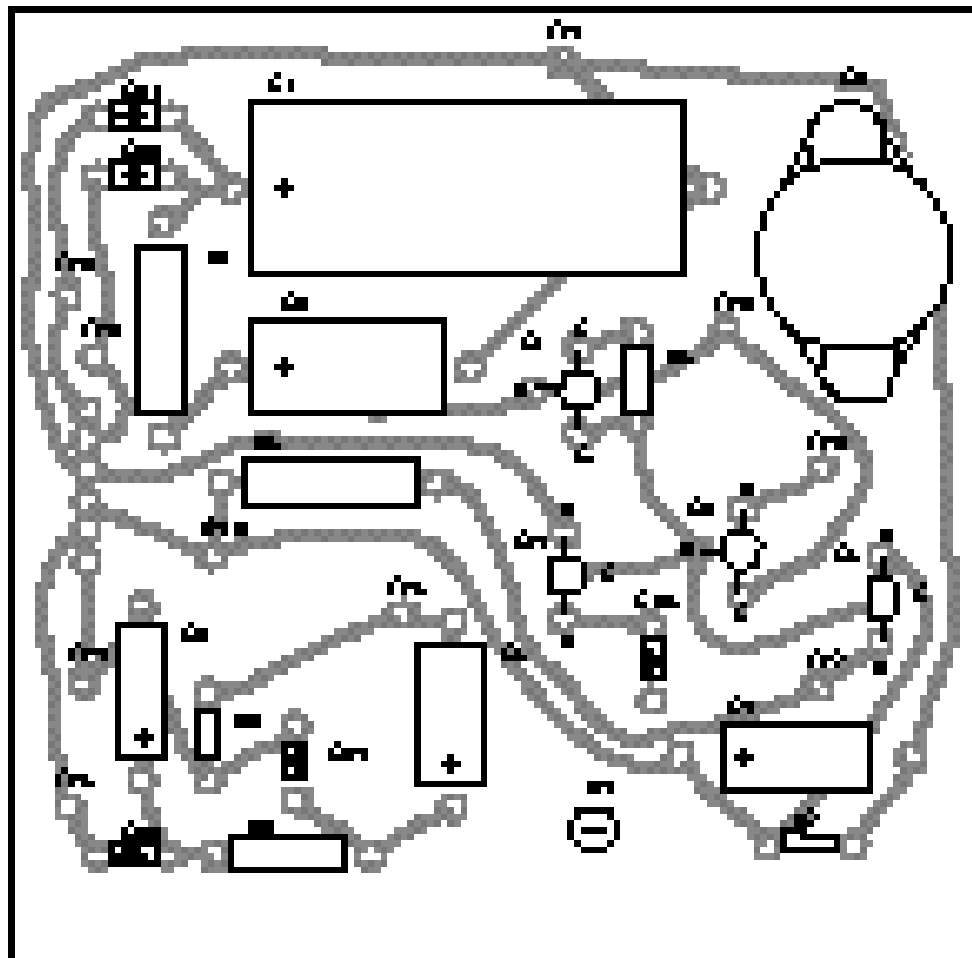
The increase of current through CCC will lower the voltage at the base of Q2 thus lowering the output voltage. Lowering this output voltage reduces the output current flow. This protects the power supply during an overcurrent condition.

UNREGULATED SECTION



REGULATED SECTION





PARTS LIST

Circuit Designation	Part Number	Part Description	Circuit Designation	Part Number	Part Description
C1	25-154	2800 μ F, 50V	S1	60-1	slide switch
C2	25-868	47 μ F, 50V	T1	54-212	transformer
C3	25-872	220 μ F, 63V		75-17	binding post
C4	25-870	100 μ F, 50V			bushing
C5	25-867	22 μ F, 50V		427-3	binding post
CR1	57-65	1N4002 silicon diode			base
CR2	57-65	1N4002 silicon diode		100-16-2	black binding post cap
CR3	57-65	1N4002 silicon diode		100-16-18	red binding post cap
CR4	56-45	zener diode (20vdc)		100-699	green binding post cap
CR5	57-65	1N4002 silicon diode		75-71	strain relief (flat cord)
DS1	412-15	NE-2H neon lamp		75-30	strain relief (round cord)
F1	421-40	fuse, slow blo 1/2 amp		75-52	switch insulator
R1	3-20-5	5 Ω , 5 watt		75-60	mica insulator
R2	1-14	3.3k Ω , 1/2 watt		75-88	transistor case insulator
R3	1-14	3.3k Ω , 1/2 watt		434-336	transistor socket
R4	10-249	variable, 5k Ω		85-1642-1	circuit board
R5	1-93	1.8k Ω , 1/2 watt		204-9	L bracket
R6	10-250	2.2 Ω , 1/2 watt		259-20	solder pins
R8	1-9	1k Ω , 1/2 watt		431-8	terminal strip
R9	1-14	3.3k Ω , 1/2 watt		413-10	neon lamp lens
RL		60 Ω		455-619	knob bushing
Q1	417-140	2N4304 field effect transistor		462-920	knob
Q2	417-109	2N3566 / 2N3053 transistor		390-1255	fuse holder
Q3	417-162	2N3055 power transistor			
Q4	417-118	2N3393 / 2N3414 transistor			
Q5	417-118	2N3393 / 2N3414 transistor			